

REMARKS

Claims 1-6 are pending in this application. Claim 6 is added herein. Support for claim 6 may be found in claim 1 as originally filed. Reconsideration is requested based on the foregoing amendment and the following remarks.

Claim Rejections - 35 U.S.C. § 102:

Claim 1 was rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 5,166,493 to Inagawa et al. (hereinafter "Inagawa"). The rejection is traversed. Reconsideration is earnestly solicited.

The third clause of claim 1 recites:

Firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom.

Inagawa neither teaches, discloses, nor suggests "firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1. Inagawa, rather, uses a short wavelength laser for smoothing the bore *wall*. In particular, as described in the Abstract:

A first step of the process is high speed rough boring by thermal processing using a long wavelength laser, and a second step is an optical chemical processing using a short wavelength laser for smoothing the bore wall.

Since Inagawa uses a short wavelength laser for smoothing the bore wall, Inagawa is not "firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as recited in claim 1.

Inagawa, in fact, is forming a *through* hole, not a hole with "a modified layer of the resin remaining at the bottom of said hole" as recited in claim 1. In particular, as described further in the Abstract:

A highly reliable through hole can be high speed processed in a short period of time.

Since Inagawa is forming a through hole, Inagawa is not "firing a laser beam of the ultraviolet

region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1.

Inagawa, moreover, is smoothing the *wall* of a *through* hole by opto-chemical processing using a short wavelength laser, not removing “a modified layer of the resin remaining at the bottom of said hole,” as recited in claim 1. In particular, as described at column 2, lines 20-28:

To attain the above first object of the invention, there is provided an apparatus, which can perform a two-step process consisting of a first step of high speed forming a hole by thermal processing using a long wavelength laser and a second step of smoothing the hole wall by opto-chemical processing using a short wavelength laser, thus obtaining a highly reliable through hole having a small diameter and excellent hole wall shape in a short period of time.

Since Inagawa is smoothing the hole wall by opto-chemical processing using a short wavelength laser, Inagawa is not “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1.

Inagawa, moreover, is finishing of the hole *wall* surface to a smooth surface with less irregularities, not removing “a modified layer of the resin remaining at the bottom of said hole,” as recited in claim 1. In particular, as described at column 2, lines 36-46:

A second object of the invention is to provide an apparatus, which provides a pulse laser beam output of a short wavelength laser such as an excimer laser for a copper foil circuit pattern part, provides a pulse laser beam output of a long wavelength laser such as a CO₂ laser for a resin part, and further provides alternate pulse laser beam outputs of short and long wavelength lasers for removal of carbide generated in the processing of the resin part, thus permitting finishing of the hole wall surface to a smooth surface with less irregularities.

Since Inagawa is finishing of the hole wall surface to a smooth surface with less irregularities, Inagawa is not “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1.

In Inagawa, moreover, the *surface* of the first *through* hole is irradiated with the short wavelength laser beam 4, not “the bottom of said hole,” as recited in claim 1. In particular, as described at column 4, lines 1-4:

In a second step, as shown in FIG. 2(c) the surface of first through hole formed in

the first step is irradiated with short wavelength laser beam 4 from short wavelength laser beam generator means (not shown).

Since, in Inagawa, the surface of the first through hole formed in the first step is irradiated with the short wavelength laser beam 4, Inagawa is not “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1.

Finally, in Inagawa, the last irradiation with excimer laser beam 2a is effected as a finish step of removing residual material from the hole wall surface *after* the through hole is formed. There *is* no “bottom of said hole,” as recited in claim 1, *after* the through hole is formed. In particular, as described at column 6, lines 10-13:

After the through hole is formed as shown in FIG. 4(d), last irradiation with excimer laser beam 2a is effected as a finish step of removing residual material from the hole wall surface.

Since, in Inagawa, the last irradiation with excimer laser beam 2a is effected as a finish step of removing residual material from the hole wall surface after the through hole is formed, Inagawa is not “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as recited in claim 1. Claim 1 is submitted to be allowable. Withdrawal of the rejection of claim 1 is earnestly solicited.

Claim Rejections - 35 U.S.C. § 103:

Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Inagawa in view of U.S. Patent Application Publication No. 2003/0049913 to Gaku et al. (hereinafter “Gaku '913”). The rejection is traversed. Reconsideration is earnestly solicited.

Claim 2 depends from claim 1 and adds further distinguishing elements. Inagawa neither teaches, discloses, nor suggests “firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom,” as discussed above with respect to the rejection of claim 1. Gaku '913 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 2. Thus, even if Inagawa and Gaku '913 were combined as proposed in the Office Action, claim 2 would not result. Claim

2 is thus submitted to be allowable. Withdrawal of the rejection of claim 2 is earnestly solicited.

Claim 3:

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Inagawa in view of U.S. Patent No. 6,280,641 to Gaku et al. (hereinafter "Gaku '641"). The rejection is traversed. Reconsideration is earnestly solicited.

Claim 3 depends from claim 1 and adds further distinguishing elements. Inagawa neither teaches, discloses, nor suggests "firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 1. Gaku '641 does not either, and thus cannot make up for the deficiencies of Inagawa with respect to claim 3. Thus, even if Inagawa and Gaku '641 were combined as proposed in the Office Action, claim 3 would not result. Claim 3 is thus submitted to be allowable. Withdrawal of the rejection of claim 3 is earnestly solicited.

Claim 4:

Claim 4 was rejected under 45 U.S.C. § 103(a) as being unpatentable over Inagawa and Gaku '641 in view of U.S. Patent No. 6,413,820 to Bui (hereinafter "Bui") or U.S. Patent No. 6,226,173 to Welsch et al. (hereinafter "Welsch"). The rejection is traversed. Reconsideration is earnestly solicited.

Claim 4 depends from claim 1 and adds further distinguishing elements. Neither Inagawa nor Gaku '641 teach, disclose, nor suggest "firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 3. Neither Bui nor Welsch do either, and thus cannot make up for the deficiencies of either Inagawa or Gaku '641 with respect to claim 4. Thus, even if Inagawa, Gaku '641, Bui, and Welsch were combined as proposed in the Office Action, claim 4 would not result. Claim 4 is thus submitted to be allowable. Withdrawal of the rejection of claim 4 is earnestly solicited.

Claim 5:

Claim 5 was rejected under 55 U.S.C. § 103(a) as being unpatentable over Inagawa and Gaku '641 in view of U.S. Patent No. 6,649,824 to Den et al. (hereinafter "Den") or U.S. Patent No. 6,226,173 to Yaita et al. (hereinafter "Yaita"). The rejection is traversed. Reconsideration is

earnestly solicited.

Claim 5 depends from claim 1 and adds further distinguishing elements. Neither Inagawa nor Gaku '641 teach, disclose, nor suggest "firing a laser beam of the ultraviolet region focused at a position where said hole is formed to remove a modified layer of the resin remaining at the bottom of said hole and form a via hole with an underlying layer exposed at its bottom," as discussed above with respect to the rejection of claim 3. Neither Den nor Yaita do either, and thus cannot make up for the deficiencies of either Inagawa or Gaku '641 with respect to claim 5. Thus, even if Inagawa, Gaku '641, Den, and Yaita were combined as proposed in the Office Action, claim 5 would not result. Claim 5 is thus submitted to be allowable. Withdrawal of the rejection of claim 5 is earnestly solicited.

New claim 6:

The eighth clause of claim 6 recites:

Exposing an underlying layer at the bottom of the via hole by removing the modified layer of the resin.

None of the cited references teach, disclose, or suggest "exposing an underlying layer at the bottom of the via hole by removing the modified layer of the resin," as discussed above with respect to the rejections of claims 1-5. Claim 6 is thus believed to be allowable for at least those reasons discussed above with respect to the rejections of claims 1-5.

Conclusion:

Accordingly, in view of the reasons given above, it is submitted that all of claims 1-6 are allowable over the cited references. Allowance of all claims 1-6 and of this entire application is therefore respectfully requested.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

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If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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